Claims

What is claimed is:

1. An antireflective hardmask layer for lithography, comprising:

a carbosilane polymer backbone comprising at least one chromophore moiety and at least one transparent moiety; and

a crosslinking component.

2. The antireflective hardmask layer of claim 1, wherein the carbosilane polymer backbone comprises SiO-containing units.

3. The antireflective hardmask layer of claim 2, wherein the carbosilane polymer backbone comprises more carbosilane than SiO-containing units.

4. The antireflective hardmask layer of claim 1, further comprising an additional crosslinking component.

5. The antireflective hardmask layer of claim 1, wherein the carbosilane polymer backbone comprises unsaturated carbon to carbon bonds.

6. The antireflective hardmask layer of claim 1, wherein the carbosilane polymer backbone comprises saturated carbon to carbon bonds.

7. The antireflective hardmask layer of claim 1, comprising from about 50 wt.% to about 98 wt.%, on a solids basis, carbosilane polymer backbone.

8. The antireflective hardmask layer of claim 1, comprising from about 70 wt.% to about 80 wt.%, on a solids basis, carbosilane polymer backbone.

9. The antireflective hardmask layer of claim 1, wherein each chromophore moiety comprises a moiety selected from the group consisting of phenyl, chrysenes, pyrenes, fluoranthrenes, anthrones, benzophenones, thioxanthones, anthracenes, anthracene derivatives, 9-anthracene methanol, phenol thiazine, non-aromatic compounds containing unsaturated carbon to carbon double bonds, compounds containing saturated carbon to carbon bonds and compositions comprising at least one of the foregoing moieties.

10. The antireflective hardmask layer of claim 1, wherein the carbosilane polymer backbone is transparent to one or more wavelengths of radiation.

11. The antireflective hardmask layer of claim 1, wherein each transparent moiety is transparent to 157 nanometer radiation.

12. The antireflective hardmask layer of claim 1, wherein a given number of the at least one transparent moiety comprise an organic moiety.

13. The antireflective hardmask layer of claim 12, wherein a given number of the at least one transparent moiety comprise a fluorocarbon substituent.

14. The antireflective hardmask layer of claim 1, wherein the crosslinking component comprises a crosslinking group selected from the group consisting of glycoluril, alcohols, aromatic alcohols, hydroxybenzyl, phenol, hydroxymethylbenzyl, cycloaliphatic alcohols, aliphatic alcohols, cyclohexanoyl, propanol, non-cyclic alcohols,

fluorocarbon alcohols, vinyl ethers, epoxides and compositions comprising at least one of the foregoing crosslinking groups.

15. The antireflective hardmask layer of claim 1, comprising from about one wt.% to about 50 wt.%, on a solids basis, crosslinking component.

16. The antireflective hardmask layer of claim 1, comprising from about three wt.% to about 25 wt.%, on a solids basis, crosslinking component.

17. The antireflective hardmask layer of claim 4, wherein the additional crosslinking component comprises an additional crosslinking group selected from the group consisting of glycoluril, methylated glycoluril, butylated glycoluril, tetramethoxymethyl glycoluril, methylpropyltetramethoxymethyl glycoluril, methylphenyltetramethoxymethyl glycoluril, 2,6-bis(hydroxymethyl)-p-cresol, etherified amino resins, methylated melamine resins, N-methoxymethyl-melamine, butylated melamine resins, N-butoxymethyl-melamine, bis-epoxies, bis-phenols, bisphenol-A and compositions comprising at least one of the foregoing additional crosslinking groups.

18. The antireflective hardmask layer of claim 1, further comprising an acid generator.

19. The antireflective hardmask layer of claim 18, wherein the acid generator comprises an acid generating group selected from the group consisting of 2,4,4,6-tetrabromocyclohexadienone, benzoin tosylate, 2-nitrobenzyl tosylate, alkyl esters of organic sulfonic acids and compositions comprising at least one of the foregoing acid generating groups.

20. The antireflective hardmask layer of claim 18, wherein the acid generator comprises a thermal acid generator.

21. The antireflective hardmask layer of claim 18, comprising from about one wt.% to about 20 wt.%, on a solids basis, acid generator.

22. The antireflective hardmask layer of claim 18, comprising from about one wt.% to about 15 wt.%, on a solids basis, acid generator.

23. A lithographic structure, comprising:

a substrate;

a material layer over the substrate;

an antireflective hardmask layer over the material layer, the antireflective hardmask layer comprising:

a carbosilane polymer backbone comprising at least one chromophore moiety and at least one transparent moiety;

a crosslinking component; and

a radiation-sensitive imaging layer over the antireflective hardmask layer.

24. A method for processing a semiconductor device, the method comprising the steps of:

providing a material layer on a substrate;

forming an antireflective hardmask layer over the material layer, the antireflective hardmask layer comprising:

a carbosilane polymer backbone comprising at least one chromophore moiety and at least one transparent moiety; and

a crosslinking component.

25. The method of claim 24, wherein the antireflective hardmask layer further comprises an acid generator.

26. The method of claim 24, wherein the carbosilane polymer backbone comprises SiO-containing units.

27. The method of claim 24, further comprising the steps of:

forming a radiation-sensitive imaging layer over the antireflective hardmask layer;

patternwise exposing the radiation-sensitive imaging layer to radiation thereby creating a pattern of radiation-exposed regions in the imaging layer;

selectively removing portions of the radiation-sensitive imaging layer and the antireflective hardmask layer to expose portions of the material layer; and

etching the exposed portions of the material layer, thereby forming a patterned material feature on the substrate.

28. The method of claim 27, further comprising the step of removing remaining radiation-sensitive imaging layer and antireflective hardmask layer from the material layer.

29. The method of claim 27, wherein the radiation is ultraviolet radiation having a wavelength of less than or equal to about 200 nanometers.

30. The method of claim 27, wherein the radiation is electron beam radiation.

31. The method of claim 24, wherein the material layer comprises a material selected from the group consisting of a conductive material, a semiconductive material, a magnetic material, an insulative material, a metal, a dielectric material and compositions comprising at least one of the foregoing materials.

32. The method of claim 24, wherein the material layer comprises at least one of an oxide, a nitride, a polysilicon and a chrome.

33. The method of claim 24, wherein the antireflective hardmask layer has a thickness of from about 0.03 micrometers to about five micrometers.

34. The method of claim 24, wherein the forming step comprises the step of baking the antireflective hardmask layer.